EXHIBIT H

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Paper 40
Entered: February 17, 2016

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC., CIENA CORPORATION, CORIANT OPERATIONS, INC., CORIANT (USA) INC., and FUJITSU NETWORK COMMUNICATIONS, INC.,
Petitioner,

v.

CAPELLA PHOTONICS, INC.,
Patent Owner.

Case IPR2014-01276[1]
Patent RE42,678 E1

Before JOSIAH C. COCKS, KALYAN K. DESHPANDE, and JAMES A. TARTAL, *Administrative Patent Judges*.

TARTAL, *Administrative Patent Judge.*

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and *37 C.F.R. § 42.73*

[1] IPR2015-00894 was joined with IPR2014-01276 on September 22, 2015, by Order in IPR2015-00894, Paper 12 (IPR2014-01276, Paper 25).

I. INTRODUCTION

Petitioner, Cisco Systems, Inc., Ciena Corporation, Coriant Operations, Inc., Coriant (USA) Inc., and Fujitsu Network Communications, Inc., filed petitions requesting an *inter partes* review of claims 1–4, 9, 10, 13, 17, 19–23, 27, 29, 44–46, 53, and 61–65 of U.S. Patent No. RE42,678 E1 ("the '678 patent"). Paper 2 ("Petition" or "Pet."); *see also* IPR2015-00894, Paper 5. Based on the information provided in the Petition, and in consideration of the Preliminary Response (Paper 7; *see also* IPR2015-00894, Paper 10) of Patent Owner, Capella Photonics, Inc., we instituted a trial pursuant to 35 U.S.C. § 314(a) of: (1) claims 1–4, 9, 10, 13, 19–23, 27, 44–46, and 61–65 as obvious over Bouevitch,[2] Smith,[3] and Lin[4] under 35 U.S.C. § 103(a); and, (2) claims 17, 29, and 53 as obvious over Bouevitch, Smith, Lin, and Dueck[5] under 35 U.S.C. § 103(a). Paper 8 ("Institution Decision"); *see also* IPR2015-00894, Paper 11.

After institution of trial, Patent Owner filed a Response (Paper 15, "Response" or "PO Resp."), and Petitioner filed a Reply (Paper 20, "Pet. Reply"). The Petition is supported by the Declaration of Dr. Dan Marom (Ex. 1028). The Response is supported by the Declaration of Dr. Alexander V. Sergienko (Ex. 2004).

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[2] U.S. Patent No. 6,498,872 B2, issued December 24, 2002 (Ex. 1003, "Bouevitch").
[3] U.S. Patent No. 6,798,941 B2, issued September 28, 2004 (Ex. 1004, "Smith").
[4] U.S. Patent No. 5,661,591, issued August 26, 1997 (Ex. 1010, "Lin").
[5] U.S. Patent No. 6,011,884, issued January 4, 2000 (Ex. 1021, "Dueck").

A transcript of the Oral Hearing conducted on November 5, 2015, is entered. Paper 39 ("Tr.").[6]

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, Petitioner has shown by a preponderance of the evidence that claims 1–4, 9, 10, 13, 17, 19–23, 27, 29, 44–46, 53, and 61–65 of the '678 patent are unpatentable.

II. BACKGROUND

A. The '678 patent (Ex. 1001)

The '678 patent, titled "Reconfigurable Optical Add-Drop Multiplexers with Servo Control and Dynamic Spectral Power Management Capabilities," reissued September 6, 2011, from U.S. Patent No. RE 39,397 ("the '397 patent"). Ex. 1001. The '397 patent reissued November 14, 2006, from U.S. Patent No. 6,625,346 ("the '346 patent"). *Id.* The '346 patent issued September 23, 2003, from U.S. Patent Application No. 09/938,426, filed August 23, 2001.

According to the '678 patent, "fiber-optic communications networks commonly employ wavelength division multiplexing (WDM), for it allows multiple information (or data) channels to be simultaneously transmitted on a single optical fiber by using different wavelengths and thereby significantly enhances the information bandwidth of the fiber." *Id.* at 1:37–42. An optical add-drop multiplexer (OADM) is used both to remove wavelengths selectively from a multiplicity of wavelengths on an optical

[6] Patent Owner's objections to Petitioner's demonstrative slides for the oral hearing are denied because we are not persuaded that Petitioner's demonstratives add new argument. *See* Paper 36. Moreover, demonstrative slides are not evidence and have not been relied upon for this final decision.

fiber (taking away one or more data channels from the traffic stream on the fiber), and to add wavelengths back onto the fiber (inserting new data channels in the same stream of traffic). *Id.* at 1:45–51.

The ’678 patent describes a “wavelength-separating-routing (WSR) apparatus that uses a diffraction grating to separate a multi-wavelength optical signal by wavelength into multiple spectral channels, which are then focused onto an array of corresponding channel micromirrors.” *Id.* at Abstract. “The channel micromirrors are individually controllable and continuously pivotable to reflect the spectral channels into selected output ports.” *Id.* According to Petitioner, the small, tilting mirrors are sometimes called Micro ElectroMechanical Systems or “MEMS.” Pet. 7. The WSR described in the ’678 patent may be used to construct dynamically reconfigurable OADMs for WDM optical networking applications. *Id.*

Figure 1A of the ’678 patent is reproduced below.

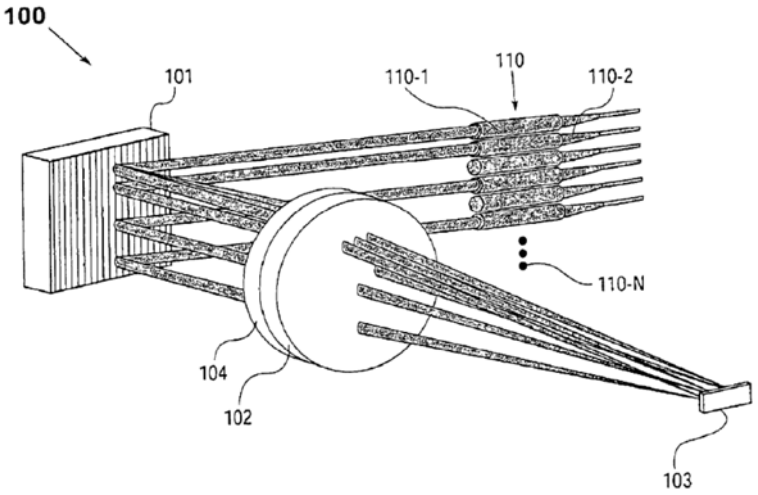

Fig. 1A

Figure 1A depicts wavelength-separating-routing (WSR) apparatus 100, in accordance with the ’678 patent. WSR apparatus 100 is composed of an array of fiber collimators 110 (multiple input/output ports, including input

port 110-1 and output ports 110-2 through 110-N), diffraction grating 101 (a wavelength separator), quarter wave plate 104, focusing lens 102 (a beam-focuser), and array of channel micromirrors 103. Ex. 1001, 6:57–63, 7:55–56.

A multi-wavelength optical signal emerges from input port 110-1 and is separated into multiple spectral channels by diffraction grating 101, which are then focused by focusing lens 102 into a spatial array of distinct spectral spots (not shown). *Id.* at 6:64–7:2. Channel micromirrors 103 are positioned such that each channel micromirror receives one of the spectral channels. *Id.* at 7:2–5.

Figure 1B of the ’678 patent is reproduced below.

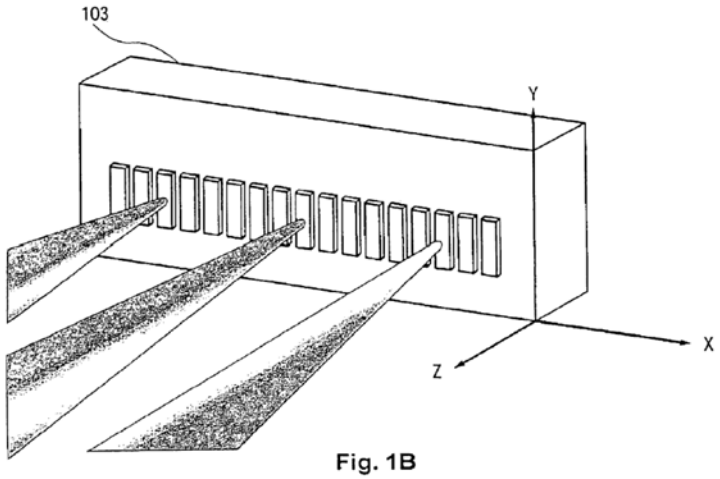

Fig. 1B

Figure 1B depicts a close-up view of the array of channel micromirrors 103 shown above in Figure 1A. *Id.* at 8:6–7. The channel micromirrors “are individually controllable and movable, e.g. pivotable (or rotatable) under analog (or continuous) control, such that, upon reflection, the spectral channels are directed” into selected output ports by way of focusing lens 102 and diffraction grating 101. *Id.* at 7:6–11.

According to the ’678 patent:

> [e]ach micromirror may be pivoted about one or two axes. What is important is that the pivoting (or rotational) motion of each channel micromirror be individually controllable in an analog manner, whereby the pivoting angle can be continuously adjusted so as to enable the channel micromirror to scan a spectral channel across all possible output ports.

Id. at 9:8–14.

Figure 3 of the ’678 patent is reproduced below.

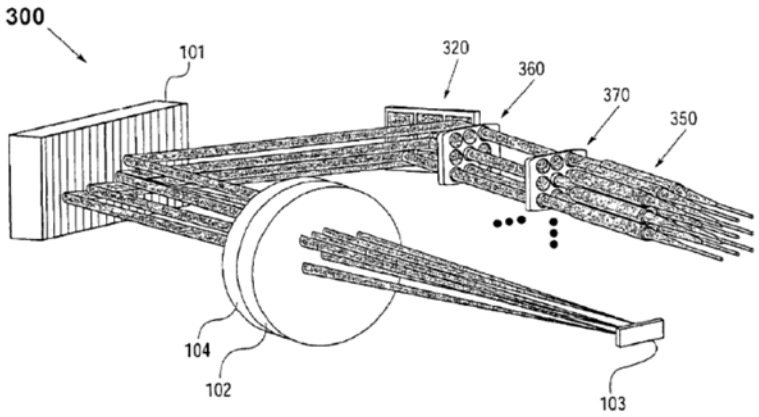

Fig. 3

Similar to Figure 1A, above, Figure 3 also shows a WSR apparatus as described by the ’678 patent. *Id.* at 10:25–26. In this embodiment, two-dimensional array of fiber collimators 350 provides an input port and plurality of output ports. *Id.* at 10:31–32. First and second two-dimensional arrays of imaging lenses 360, 370 are placed in a telecentric arrangement between two-dimensional collimator-alignment mirror array 320 and two-dimensional fiber collimator array 350. *Id.* at 10:37–43. “The channel micromirror 103 must be pivotable biaxially in this case (in order to direct its corresponding spectral channel to any one of the output ports).” *Id.* at 10:43–46.

The WSR also may incorporate a servo-control assembly (together termed a "WSR-S apparatus"). *Id.* at 4:65–67. According to the '678 patent:

> The servo-control assembly serves to monitor the power levels of the spectral channels coupled into the output ports and further provide control of the channel micromirrors on an individual basis, so as to maintain a predetermined coupling efficiency of each spectral channel in one of the output ports. As such, the servo-control assembly provides dynamic control of the coupling of the spectral channels into the respective output ports and actively manages the power levels of the spectral channels coupled into the output ports.

Id. at 4:47–56.

Figure 5 of the '678 patent is reproduced below.

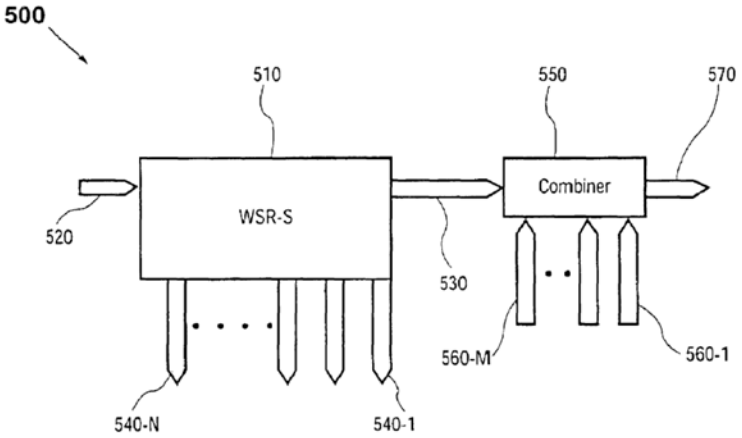

Fig. 5

Figure 5 depicts OADM 500 in accordance with the '678 patent composed of WSR-S (or WSR) apparatus 510 and optical combiner 550. *Id.* at 12:40–44. Input port 520 transmits a multi-wavelength optical signal, which is separated and routed into a plurality of output ports, including pass-through port 530 and one or more drop ports 540-1 through 540-N. *Id.* at 12:44–48. Pass-through port 530 is optically coupled to optical combiner 550, which

combines the pass-through spectral channels with one or more add spectral channels provided by one or more add ports 560-1 through 560-M. *Id.* at 12:52–56. The combined optical signal is then routed into an existing port 570, providing an output multi-wavelength optical signal. *Id.* at 12:56–58.

B. Illustrative Claims

Challenged claims 1, 21, 44, and 61 of the '678 patent are independent. Challenged claims 2–4, 9, 10, 13, 17, 19, and 20 ultimately depend from claim 1; claims 22, 23, 27, and 29 ultimately depend from claim 21; claims 45, 46, and 53 ultimately depend from claim 44; and, claims 62–65 ultimately depend from claim 61. Claims 1, 21, and 61 of the '678 patent are illustrative of the claims at issue:

> 1. A wavelength-separating-routing apparatus, comprising:
>
> a) multiple fiber collimators, providing an input port for a multi-wavelength optical signal and a plurality of output ports;
>
> b) a wavelength-separator, for separating said multi-wavelength optical signal from said input port into multiple spectral channels;
>
> c) a beam-focuser, for focusing said spectral channels into corresponding spectral spots; and
>
> d) a spatial array of channel micromirrors positioned such that each channel micromirror receives one of said spectral channels, said channel micromirrors being *pivotal about two axes and being* individually and continuously controllable to reflect [[said]] *corresponding received* spectral channels into *any* selected ones of said output ports *and to control the power of said received spectral channels coupled into said output ports*.

Ex. 1001, 14:6–23 (emphases in original, "[[ ]]" indicating matter in the first reissue that forms no part of the second reissue, and matter in italics indicating additions made by second reissue).

> 21. A servo-based optical apparatus comprising:
>
> a) multiple fiber collimators, providing an input port for a multi-wavelength optical signal and a plurality of output ports;
>
> b) a wavelength-separator, for separating said multi-wavelength optical signal from said input port into multiple spectral channels;
>
> c) a beam-focuser, for focusing said spectral channels into corresponding spectral spots; and
>
> d) a spatial array of channel micromirrors positioned such that each channel micromirror receives one of said spectral channels, said channel micromirrors being individually controllable to reflect said spectral channels into selected ones of said output ports; and
>
> e) a servo-control assembly, in communication with said channel micromirrors and said output ports, for maintaining a predetermined coupling of each reflected spectral channel into one of said output ports.

Ex. 1001, 15:29–48.

> 61. A method of performing dynamic wavelength separating and routing, comprising:
>
> a) receiving a multi-wavelength optical signal from an input port;
>
> b) separating said multi -wavelength optical signal into multiple spectral channels;
>
> c) focusing said spectral channels onto a spatial array of corresponding beam-deflecting elements, whereby each beam-deflecting element receives one of said spectral channels; and
>
> d) dynamically and continuously controlling said beam-deflecting elements [[, thereby directing]] *in two dimensions to direct* said spectral channels into [[a plurality]] *any selected ones of said* output ports *and to control the*

> *power of the spectral channels coupled into said selected output ports*.

Ex. 1001, 18:55–19:3 (emphases in original, with "[[ ]]" indicating matter in the first reissue that forms no part of the second reissue, and matter in italics indicating additions made by second reissue).

III. ANALYSIS

A. Real Party-In-Interest

Patent Owner contends that trial should be terminated because Petitioner did not identify all real parties-in-interest. PO Resp. 60. Patent Owner does not expressly state who else it contends is a real party-in-interest or why. Patent Owner merely identifies a supplier "of the accused products," and asserts that supplier is "is required to indemnify . . . pursuant to California Commercial Code § 2312(3)." *Id.* Patent Owner provides no explanation of its contention, fails to analyze any facts relative to its contention, and directs us to no legal authority in support of its contention. Accordingly, we are not persuaded that trial should be terminated under the circumstances presented.

B. Claim Construction

Only terms which are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

1. *"to reflect"* and *"to control"*

Independent claims 1 and 44 each recite outside of the preamble:

> [A] spatial array of channel micromirrors positioned such that each channel micromirror receives one of said spectral channels, said channel micromirrors being pivotal about two axes and being individually and continuously controllable <u>to reflect</u>

> corresponding received spectral channels into any selected ones of said output ports and <u>to control</u> the power of said received spectral channels coupled into said output ports.

Ex. 1001, 14:16–23, 17:43–52 (emphases added and omitted). Independent claim 61 contains a similar limitation.[7] Independent claim 21 recites "to reflect said spectral channels," but does not contain a "to control" limitation. *Id.* at 15:43. Petitioner contends that the "to reflect" and "to control" clauses are non-functional clauses that say nothing about the claimed structure, and, therefore, are non-limiting. Pet. 10–11. We disagree. Although "apparatus claims cover what a device is, not what a device does," the language at issue here describes the function that the apparatus must be capable of performing. *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1468 (Fed.Cir.1990); *see also K-2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1363 (Fed. Cir. 1999) (explaining that functional language is an additional limitation in the claim).[8] In that regard, the apparatus must be capable of performing the functions "to reflect" and "to control," and, therefore, the pertinent clauses are functional rather than non-functional. Accordingly, the claimed "spatial array of channel micromirrors" is further limited to a spatial array that satisfies the "to reflect" and "to control" functional limitations.

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[7] Claim 61 recites: "dynamically and continuously controlling said beam-deflecting elements in two dimensions to direct said spectral channels into any selected ones of said output ports and to control the power of the spectral channels coupled into said selected output ports." Ex. 1001, 18:65–19:3 (emphases omitted).

[8] For the same reasons we decline to adopt for purposes of this decision Petitioner's proposition that other claim phrases reciting "wherein," "whereby," and "for" should be considered non-limiting. *See* Pet. 10–11.

2. "*continuously controllable*"

Claims 1 and 44 require "a spatial array of channel micromirrors . . . being individually and continuously controllable." Ex. 1001, 14:16–20; 17:43–47. Similarly, claim 61 requires "dynamically and continuously controlling said beam-deflecting elements." *Id.* at 18:65–66. Petitioner asserts that "continuously controllable" should be construed to mean "under analog control." Pet. 11. Petitioner identifies the following disclosures of the '678 patent as supporting its proposed construction:

> The patent explains that "[a] distinct feature of the channel micromirrors in the present invention, in contrast to those used in the prior art, is that the motion…of each channel micromirror is under *analog control* such that its pivoting angle can be *continuously adjusted*." ([Ex. 1001], 4:7–11). Another passage in the specification states that "[w]hat is important is that the pivoting (or rotational) motion of each channel micromirror be individually *controllable in an analog manner, whereby the pivoting angle can be continuously adjusted* so as to enable the channel micromirror to scan a spectral channel across all possible output ports." ([Ex. 1001], 9:9–14). Yet another passage states that "channel micromirrors 103 are individually controllable and movable, e.g., pivotable (or rotatable) under analog (or continuous) control." (*Id.*, 7:6–8).

Pet. 11–12.

Dr. Marom also explains that "MEMS can be operated using analog voltage for continuous control," and states that a person of ordinary skill in the art would understand continuous control "is achieved via analog voltage control." Ex. 1028 ¶¶ 37, 63.

Patent Owner suggests in its Response that analog control does not necessarily provide the claimed "continuous control" (PO Resp. 46 n.8), but during the oral hearing counsel for Patent Owner indicated that

"continuously controllable" was defined as "analog control," and then clarified that Patent Owner "did not offer a specific definition of continuously control." Tr. 57:1–58:2. Additionally, according to Dr. Sergienko, "continuous control cannot be shown by the input signal (*i.e.*, analog vs. digital) alone." Ex. 2004 ¶ 181.

Based on all of the evidence presented, we are not persuaded that "continuously controllable" is limited to "analog control," or that "analog control" necessarily corresponds to "continuous" control under all circumstances. Indeed, counsel for Petitioner suggested that, although the art at issue disclosed analog control that provided continuous control, counsel further recognized that it may operate differently outside of that art. *See* Tr. 30:24–31–6. We determine that "continuously controllable," in light of the specification of the '678 patent, encompasses "under analog control such that it can be continuously adjusted."

3. "*providing*"

Claims 1, 21, and 44 recite "collimators, providing an input port . . . and a plurality of output ports." Petitioner contends that the '678 patent does not use "providing" outside of its ordinary and customary meaning "to make available." Pet. Reply 8 (citing Ex. 1054). Patent Owner did not propose an express meaning of "providing," but according to Petitioner, Patent Owner implicitly argues that it required some element of exclusivity and one-to-one correspondence. *Id.* at 9–10. Indeed, Patent Owner argues that "the structure or elements making up the ports are collimators," and that "[a]s uniformly described and claimed in the '678 [p]atent, multiple fiber collimators provide at least one input port and respective multiple output

ports." PO Resp. 35. To the extent Patent Owner can be understood to be arguing for a construction of "providing" that requires that only one collimator directly provide one port, Patent Owner has provided no persuasive support for such a contention. *See also* Pet. Reply 10–11 (noting that a provisional application to the '678 patent disclosed ports being made available through both collimators and circulators). In light of the specification of the '678 patent, we apply the plain and ordinary meaning of "providing" as "making available."

4. "port"

Claim 61 recites "receiving a multi-wavelength optical signal from an input port," and "controlling said beam deflecting elements . . . to direct said spectral channels into . . . output ports." Ex. 1001, 18:57–19:1. Patent Owner contends that in the '678 patent "the structure or elements making up the ports are collimators." PO Resp. 34. Patent Owner offers no definition of "port," and does not suggest that the '678 patent provides an express definition of the term, but instead argues that a "port," as claimed, is not a "circulator port" because the '678 patent "disavows circulator-based optical systems." *Id.* at 35. We disagree.

There is no dispute that the ordinary and customary meaning of "port" encompasses circulator ports, and, indeed, any "point of entry or exit of light." *See* Dr. Sergienko Deposition Transcript (Ex. 1049), 43:16–23, 45:12–13 ("The circulator ports are ports with constraints."). Nor does the '678 patent equate the term "port" to "collimator," as both "port" and "collimator" appear separately in the claims of the '678 patent. Ex. 1001, 14:8–10. We have considered the testimony of Dr. Sergienko as well

(Ex. 2004 ¶¶ 146–167), and find that even if certain fiber collimators serve as ports in the '678 patent, that does not redefine the term "port" to mean "collimator." *See id.* ¶ 154. Thus, the primary issue is whether the '678 patent disavows circulator ports from the scope of the term "port."

Although the broad scope of a claim term may be intentionally disavowed, "this intention must be clear," *see Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1325 (Fed. Cir. 2002) ("The patentee may demonstrate an intent to deviate from the ordinary and accustomed meaning of a claim term by including in the specification expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope,"), and cannot draw limitations into the claim from a preferred embodiment." *Conoco, Inc. v. Energy & Envtl. Int'l., L.C.*, 460 F.3d 1349, 1357 (Fed. Cir. 2006).

Patent Owner fails to show any "expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope" with respect to the use of "port" in the '678 patent. Patent Owner argues that the '678 patent provides a scalable system without circulator ports (PO Resp. 9–10), that a provisional application to the '678 patent "describes existing add/drop architectures that had a number of problems" (PO Resp. 36), that Dr. Marom obtained a patent in which collimators serve as the ports (PO Resp. 40–41), and that "[b]ecause the inventors of the '678 [p]atent consistently emphasized the limitations of circulator-based switches and the '678 [p]atent discloses an alternative configuration, a [person of ordinary skill in the art] would have understood that the inventors were disavowing the use of optical circulators." PO Resp. 37 (citing Ex 2004 ¶ 161).

We do not discern any "clear disavowal of claim scope" from the arguments advanced by Patent Owner. Dr. Sergienko merely states that a person of ordinary skill in the art "would have read the '678 patent as teaching away from or at the least discouraging the use of circulators." Ex. 2004, ¶ 160. Even if the '678 patent were viewed as Dr. Sergienko suggests, teaching away or discouragement is not disavowal. Moreover, Petitioner further demonstrates that a provisional application to the '678 patent in fact uses circulator ports as "ports." Pet. Reply 11–13 (citing Ex. 1008, 4, Fig. 9). Such usage undermines Patent Owner's disavowal contention. We have considered all of the arguments advanced by Patent Owner in its effort to redefine "port" as excluding "circulator ports" (PO Resp. 34–41), and find insufficient support for Patent Owner's contention that the '678 patent disavows circulator ports from the scope of the term "port." We determine that "port," in light of the specification of the '678 patent, encompasses "circulator port."

5. "*beam-focuser*"

Claims 1, 21, and 44 require a "beam-focuser, for focusing said spectral channels into corresponding spectral spots." Ex. 1001, 14:14–15, 15:37–38, 17:41–42. The '678 patent states that "[t]he beam-focuser may be a single lens, an assembly of lenses, or other beam focusing means known in the art." *Id.* at 4:20–22.

Petitioner contends that "beam-focuser" is "a device that directs a beam of light to a spot." Pet. 14. According to Petitioner:

> The Summary of the '678 patent states that the "beam-focuser focuses the spectral channels into corresponding spectral spots." ([Ex. 1001], 3:63–64.) The specification also explains that the

> beams of light are "focused by the focusing lens 102 into a spatial array of distinct spectral spots (not shown in FIG. lA) in a one-to-one correspondence." (*Id.*, 6:65–7:5.) The MEMS mirrors are in turn "positioned in accordance with the spatial array formed by the spectral spots, such that each channel micromirror receives one of the spectral channels." (*Id.*)

Id. at 14–15. Patent Owner does not dispute expressly Petitioner's proposed construction, and provides no alternative construction of "beam-focuser." Consistent with Petitioner's proposed construction, Dr. Sergienko testified that "focusing means bringing of the energy in the original image limited to the focal spot." Dr. Sergienko Deposition Transcript (Ex. 1049), 245:17–19. We agree that, based on the specification of the '678 patent, "beam-focuser" means "a device that directs a beam of light to a spot."

6. "*servo-control assembly*"

Claims 2–4, 21–23, 45, and 46 recite a "servo-control assembly." Petitioner asserts "servo-control assembly" means "feedback-based control assembly." Pet. 12. Patent Owner offers no construction of the term.

We are not persuaded that "servo" necessarily means "feedback-based," as suggested by Petitioner, merely because the '678 patent describes a processing unit within a servo-control assembly as using power measurements from the spectral monitor to provide feedback control of the channel mirrors. *Id.* at 12–13. the '678 patent states that the "servo-control assembly serves to monitor the power levels of the spectral channels coupled into the output ports and further provide control of the channel micro mirrors on an individual basis." Ex. 1001, 4:47–50. Further, "[i]f the WSR apparatus includes an array of collimator-alignment mirrors . . . the servo-control assembly may additionally provide dynamic control of the

collimator-alignment mirrors. *Id.* at 4:56–60. According to the '678 patent, "[a] skilled artisan will know how to implement a suitable spectral monitor along with an appropriate processing unit to provide a servo-control assembly in a WSP-S apparatus according to the present invention, for a given application." Ex. 1001, 12:11–15.

Based on the specification and the present record, a "servo-control assembly" encompasses a spectral monitor and processing unit to monitor spectral channel power levels and control channel micro mirrors on an individual basis. *See id.* at 11:10–36.

7. "*servo-based*"

Claims 21–23, 27, and 29 recite a "servo-based optical apparatus." Petitioner asserts that "servo-based" means "feedback-based control." Pet. 12. Patent Owner offers no construction of the term.

The '678 patent does not use the term "servo-based" outside of the preamble of the claims.

> If . . . the body of the claim fully and intrinsically sets forth the complete invention, including all of its limitations, and the preamble offers no distinct definition of any of the claimed invention's limitations, . . . then the preamble is of no significance to claim construction because it cannot be said to constitute or explain a claim limitation.

Pitney Bowes, Inc. v. Hewlett-Packard Co., 182 F.3d 1298, 1305, (Fed. Cir. 1999) (citations omitted). The bodies of claims 21–23, 27, and 29 fully and intrinsically set forth the complete invention; therefore, the use of "servo-based" in the preamble does not serve as a limitation and need not be construed.

8. "*dynamically*"

Claim 61 recites "[a] method of performing dynamic wavelength separating and routing, comprising: . . . dynamically and continuously controlling said beam-deflecting elements in two dimensions." Ex. 1001, 18:65–67. Petitioner contends that "[t]he plain and ordinary meaning of 'dynamically' controlling in the context of the '678 patent is 'during operation.'" Pet. 57 (citing Ex. 1001, 3:22–23 (contrasting routing that is fixed during operation: "the [prior art] wavelength routing is intrinsically static, rendering it difficult to dynamically reconfigure these OADMs."); Ex. 1028 ¶¶ 142–144). It is unclear how Petitioner equates "dynamically" to "during operation" from the citation provided. Patent Owner does not propose a definition of "dynamically."

The '678 patent uses "dynamic" and "dynamically" throughout the specification, stating, for example, that "[t]he power levels of the spectral channels in the output ports may be dynamically managed according to demand." Ex. 1001, 11:30–32. We determine from the specification that the '678 patent uses "dynamically" in contrast to "static," in accordance with its ordinary and customary meaning.

9. Additional Claim Terms

Petitioner addresses several additional claim terms, including "spectral monitor" and "in two dimensions." Pet. 13–16. For purposes of this decision, no express construction of any additional claim term is necessary.

C. References Asserted as Prior Art

Petitioner relies on Bouevitch, Smith, Lin, and Dueck with respect to its assertion that the challenged claims would have been obvious.

1. Bouevitch

Bouevitch describes an optical device for rerouting and modifying an optical signal, including modifying means such as a MEMS array and a liquid crystal array which function as an attenuator when the device operates as a dynamic gain equalizer (DGE), and as a switching array when the device operates as a configurable optical add/drop multiplexer (COADM). Ex. 1003, Abstract. According to Petitioner, the COADM described in Bouevitch "uses MEMS mirrors with 1 axis of rotation." Pet. 18. Petitioner also contends that the Bouevitch COADM controls the power of its output channels by tilting beam-deflecting mirrors at varying angles. *Id.*

2. Smith

Smith describes an optical switch including an array of mirrors tiltable about two axes, permitting a mirror tilt axis to be used for switching and a perpendicular axis to be used for power control. Ex. 1004, Abstract, 16:34–51; *see also* Ex. 1005 (the Smith '683 Provisional), 6 (describing the same). Petitioner contends that "to the extent Bouevitch does not disclose 2-axis mirrors and their intended use for power control, both the Smith Patent and the Smith ['683] Provisional each does so." Pet. 19. Petitioner asserts that Smith is § 102(e) prior art as of the September 22, 2000, filing date of the Smith '683 Provisional. Pet. 17. Patent Owner argues that Smith is not prior art to the '678 patent because the portions of Smith Petitioner relies

upon are not entitled to the filing date of the Smith '683 Provisional. PO Resp. 58–60.

During this proceeding, the Federal Circuit issued a decision in *Dynamic Drinkware, LLC, v. National Graphics, Inc*., 800 F.3d 1375 (Fed. Cir. 2015), addressing the necessary showing for a patent to claim priority from the filing date of its provisional application. The court found that the petitioner in the underlying *inter partes* review proceeding did not demonstrate that the prior art patent relied upon was entitled to the benefit of the filing date of its provisional application because the petitioner did not show written description support in the prior art provisional application f*or the claims of the prior art patent*. *Id.* at 1378. Thus, demonstrating only that the provisional application of the prior art patent provided a written description of the *subject matter* in the prior art patent relied upon to establish the unpatentability of the challenged claims was insufficient to show that the prior art patent was entitled to the benefit of the filing date of its provisional application. *Id.*

In this case, Petitioner recognized that it had not shown in the Petition that the Smith '683 Provisional provided written description support *for the claims of Smith* and requested an opportunity to address the issue in light of *Dynamic Drinkware*. *See* Paper 22 (authorizing additional briefing). With our authorization, Petitioner filed a brief addressing the holding in *Dynamic Drinkware* and whether the Smith '683 Provisional provides written description support for the claims of Smith. Paper 30. Patent Owner filed a brief in response. Paper 33.

The parties generally agree that Smith is § 102(e) prior art as of the filing date of the Smith '683 Provisional if the Smith '683 Provisional provides written description support for: (1) the subject matter Petitioner relies upon in Smith to show the unpatentability of the challenged claims of the '678 patent, and (2) the invention of Smith.[9] *See* Paper 30, 2; *see also* Paper 33, 1 ("When relying on a provisional's filing date for a § 103 rejection, a petitioner must show: (1) the subject matter was carried over from the provisional application and (2) the patent's claims have § 112 support in the provisional application.").

First, Petitioner has shown sufficiently that the Smith '683 Provisional provides written description support for at least two claims of Smith. Petitioner provides a claim chart identifying each of the limitations of claim 1 of Smith and the corresponding written description support as disclosed by

[9] We agree with Petitioner that it need not show that every claim of Smith is supported by the Smith '683 Provisional to demonstrate that subject matter disclosed in both Smith and the Smith '683 Provisional is entitled to the benefit of the filing date of the Smith '683 Provisional. *See* Paper 30, 3. We also need not reach, and take no position on Petitioner's suggestion that *Dynamic Drinkware* is invalid to the extent it conflicts with *In re Klesper*, 397 F.2d 882 (CCPA 1968) (stating "[i]t is also well settled that where a patent purports on its face to be a 'continuation-in-part' of a prior application, the continuation-in-part application is entitled to the filing date of the parent application as to all subject matter carried over into it from the parent application, whether for purposes of obtaining a patent or subsequently utilizing the patent disclosure as evidence to defeat another's right to a patent. 35 U.S.C. §§ 102(e), 120; *Goodyear Tire & Rubber Co. v. Ladd*, 121 U.S. App. D.C. 275, 349 F.2d 710, (1965), certiorari denied 382 U.S. 973, 86 S. Ct. 536, 15 L.Ed.2d 465; *Asseff v. Marzall*, 88 U. S. App. D.C. 358, 189 F.2d 660, (1951), certiorari denied 342 U.S. 828, 72 S. Ct. 51, 96 L. Ed. 626; *In re Switzer*, 166 F.2d 827, 35 CCPA 1013.").

the Smith '683 Provisional. Paper 30, attached claim chart. Petitioner also identifies written description support in the Smith '683 Provisional for Smith claim 28. *Id.* at 5.

We have considered Patent Owner's argument that the claim chart provided by Petitioner "is mere attorney argument and does not even attempt to demonstrate what a [person of ordinary skill in the art] would understand or whether the disclosure has §112 support in the Provisional," and are not persuaded. Paper 33, 5. Patent Owner identifies no authority for the proposition that an expert declaration is necessary to show written description support. Patent Owner's further argument that Petitioner "is wrong" in its assertion that the "movable mirror" of Smith is supported by the disclosure of "elements that can be rotated in an analog fashion," is not persuasive because it is conclusory and does not address the full disclosure identified by Petitioner.

Second, Petitioner has shown sufficiently that the Smith '683 Provisional provides written description support for certain subject matter Petitioner relies upon in Smith to show the unpatentability of the challenged claims of the '678 patent (i.e., that "the subject matter was carried over from the provisional application.") According to Petitioner, the Smith '683 Provisional "describes 'a mirror array with elements that can be rotated in an analog fashion about two orthogonal axes,' with one axis for switching, and one axis for power." Pet. 19 (quoting Ex. 1005, 6). In support of Petitioner's contention that Smith is § 102(e) prior art, Dr. Marom testifies that the Smith '683 Provisional discloses all of the features of Smith relied upon to demonstrate unpatentability. Ex. 1028 ¶ 153. In his declaration,

Dr. Marom provides a chart identifying the claimed subject matter of the '678 patent and the corresponding disclosures in both Smith and the Smith '683 Provisional. *Id.* ¶ 154. In particular, Dr. Marom identifies the individually and continuously controllable in two dimensions limitation of claims 1, 21, 44, and 61 of the '678 patent as being described by the Smith '683 Provisional as a "mirror array with elements that can be rotated in an analog fashion about two orthogonal axes." *Id.* (quoting Ex. 1005, 6) (emphasis omitted).

Patent Owner argues that the Smith '683 Provisional does not provide written description support for Smith's disclosure of the "continuously controllable" limitation of the '678 patent. PO Resp. 59–60. Although Dr. Marom expressed the opinion that the Smith '683 Provisional discloses the "continuously controllable" limitation based on its disclosure of "analog" control, Petitioner does not rely only on Smith as disclosing the "continuously controllable" limitation. *See* Pet. 28, 30. Accordingly, whether the Smith '683 Provisional discloses the "continuously controllable" limitation has no bearing on whether Smith is available as prior art for any other disclosure upon which Petitioner relies. Similarly, to the extent Patent Owner argues that a gimbal structure described in Smith was not disclosed in the Smith '683 Provisional, Patent Owner's argument is beyond the scope of the claims of the '678 patent, which do not require a particular gimbal structure, and is not persuasive as Petitioner does not rely on the disclosure of a gimbal structure to demonstrate the unpatentability of any claim of the '678 patent.

We determine that Smith is available as prior art with an effective date of the filing date of the Smith '683 Provisional for subject matter carried over to Smith from the provisional application, including the disclosure of 2-axis mirrors to control switching and power.

3. Lin

Lin describes a "spatial light modulator . . . operable in the analog mode for light beam steering or scanning applications." Ex. 1010, Abstract. Lin explains that the angular deflection of a mirror about the torsional axis is a function of the voltage potential applied to an address electrode. *Id.* at 6:29–32. Petitioner contends that Figure 3B of Lin depicts a continuous and linear relationship between the deflection angle of the MEMS mirrors and the applied voltage. Pet. 30.

4. Dueck

Dueck describes a wavelength division multiplexer that integrates an axial gradient refractive index element with a diffraction grating to provide efficient coupling from a plurality of input sources. Ex. 1021, Abstract. Petitioner contends that Dueck describes various diffraction gratings for use in WDM devices. Pet. 17.

D. Asserted Obviousness Over Bouevitch, Smith, and Lin

Petitioner asserts that claims 1–4, 9, 10, 13, 19–23, 27, 44–46, and 61–65 would have been obvious over Bouevitch, Smith, and Lin.[10] Pet. 23–60.

1. Claim 1

Claim 1, directed to a wavelength-separating-routing apparatus, requires "multiple fiber collimators, providing an input port . . . and a plurality of output ports." Ex. 1001, 14:6–10. Petitioner contends that Bouevitch describes microlenses 12a and 12b, corresponding to the recited "multiple fiber collimators." Pet. 24. Petitioner's declarant, Dr. Marom, equates microlenses 12a and 12b to fiber collimators. Petitioner further asserts that the microlenses of Bouevitch, in conjunction with fiber waveguides and circulators, provide an input port (labeled "IN"), and a plurality of output ports (labeled "OUT EXPRESS" and "OUT DROP"). Pet. 24–25 (citing Ex. 1003, 14:14–21, Fig. 11). Petitioner's contentions are supported by Dr. Marom. Ex. 1028 ¶¶ 52–53.

[10] Petitioner initially argues that Patent Owner admitted in a Replacement Reissue Application Declaration by Assignee that all elements of claim 1, except for two-axis mirrors, were disclosed by Bouevitch. Pet. 7–9 (quoting Ex. 1002, 81–82). Petitioner identifies no persuasive authority for the proposition that such a statement should be treated as an admission in this proceeding. Moreover, rather than admit that all original elements of claim 1 are disclosed by Bouevitch, the statement makes clear that three additional references not relied upon by Petitioner in this proceeding were considered in combination with Bouevitch. As a result, we are not persuaded that Patent Owner has admitted all elements of claim 1, except for two-axis mirrors, were disclosed by Bouevitch.

Patent Owner argues that under the "proper meaning" of the claim, Bouevitch's two circulators coupled to two microlenses "do not meet the distinct structure" of the claimed "multiple fiber collimators, providing an input port . . . and a plurality of output ports."[11] PO Resp. 34–35. We find no support for Patent Owner's contentions. Patent Owner does not articulate any express construction of a claim term as corresponding to the "proper meaning" to which it refers. As discussed above, we construe "providing" to mean "making available," and Patent Owner does not expressly argue to the contrary. Instead, Patent Owner identifies a figure from the specification of the '678 patent and argues that the specification describes "one collimator providing one input port and five collimators providing respective five output ports." *Id.* That, however, is not the language of claim 1, and we will not read limitations from the specification into the claims of the '678 patent.

Patent Owner also argues that, under its proposed claim construction of "port," Bouevitch discloses at most two ports because the '678 patent equates "port" to "collimator," and disavows "circulator-based optical systems." PO Resp. 35–42. For the reasons explained above in our claim construction analysis for "port," we reject Patent Owner's claim construction for "port." Accordingly, we do not agree with Patent Owner's contention that the only ports disclosed by Bouevitch are collimator lenses 12a and 12b. Petitioner has shown, as discussed above and as supported by Dr. Marom,

[11] Patent Owner contends that claim 1 is "representative" of claims 21, 44, and 61, and states that "[t]he claims of the patent refer not merely to ports, but to fiber collimators, providing ports." PO Resp. 33–34. Contrary to Patent Owner's assertion, claim 61 recites "ports," and does not recite "collimators."

that Bouevitch discloses the "multiple fiber collimators, providing an input port . . . and a plurality of output ports," as recited by claim 1.

Claim 1 further requires "a wavelength-separator." Petitioner identifies diffraction grating 20 of Bouevitch as corresponding to the recited "wavelength-separator." Pet. 25. Petitioner contends, and we agree, that Bouevitch discloses a "wavelength-separator, for separating said multi-wave-length optical signal from said input port into multiple spectral channels" at Figure 11, where diffraction grating 20 spatially separates combined channels $\lambda_1\lambda_2$ into spatially-separated channels. *Id.* at 25–26 (citing Ex. 1003, 14:48–53, 8:10–22; Ex. 1028 ¶ 54).

Claim 1 also requires "a beam-focuser." Petitioner identifies reflector 10 of Bouevitch (as well as the lens system 202 of Smith) as corresponding to the recited "beam-focuser." Pet. 26–27. Petitioner explains that in Bouevitch "reflector 10 focuses the separated spectral channels of light λ_1 and λ_2 from the points on the reflector annotated as 'R' onto point on the corresponding mirrors 51 & 52 in MEMS array 50." *Id.* Petitioner identifies MEMS mirror array 50 of Bouevitch as corresponding to the recited "spatial array of channel micromirrors positioned such that each channel micromirror receives a corresponding one of said spectral channels." Pet. 27–28. Patent Owner does not dispute Petitioner's contentions, with which we agree.

For each of the channel micromirrors, claim 1 further requires that they be "*pivotal about two axes*," and be "individually and continuously controllable to reflect *corresponding received* spectral channels into *any* selected ones of said output ports *and to control the power of said received spectral channels coupled into said output ports*." Petitioner contends that

each micromirror in MEMS array 50 of Bouevitch is "individually" controllable to deflect a beam to either output port 80a or 80b. Pet. 28 (citing Ex. 1028 ¶ 62). Petitioner also contends that both Bouevitch and Smith "describe how the goal of controlling the MEMS mirrors is to effect the add/drop process, which includes reflecting the spectral channels to selected add/drop ports. Pet. 33 (citing Ex. 1003, 14:66–15:18; Ex. 1004, Fig. 5, 8:47–59, 12:4–12, 10:37–44; Ex. 1028 ¶ 75.)

Patent Owner argues that the beam in Bouevitch is "propagated" to an output port, and that Petitioner has not shown that "deflecting" or "propagating" to an output port is "reflecting," as claimed. PO Resp. 42–43. We find Patent Owner's argument not persuasive. First, Patent Owner does not dispute that Smith discloses "reflecting" as claimed. Second, Patent Owner provides no construction of "to reflect" to explain why a beam that is reflected and then propagated or deflected is excluded. Third, Petitioner has shown that Patent Owner's argument implies a requirement that the beam be directly reflected to an output port which is contrary to an embodiment of the '678 patent. *See* Pet. Reply 17–18. We agree with Petitioner, as discussed above, that both Smith and Bouevitch disclose micromirrors that "reflect" spectral channels to output ports, as claimed.

With regard to continuous control, as explained by Dr. Marom, Bouevitch discloses the use of variable attenuation for power control, and a person of ordinary skill in the art would understand that the necessary level of control required to balance the optical power differentials among the wavelength channels is achieved in Bouevitch with continuous control over the mirror tilt via analog voltage control. *See* Ex. 1028 ¶ 63, *see also*

Ex. 1003, 7:35–37 ("The degree of attenuation is based on the degree of deflection provided by the reflector (i.e., the angle of reflection).").

Patent Owner does not dispute Petitioner's contention that Bouevitch discloses continuous control of beam-deflecting elements via analog voltage control with respect to a single axis. Instead, Patent Owner argues that "Petitioner explicitly concedes that Bouevitch does not teach or suggest micromirrors being pivotable about two axes." PO Resp. 44.

There is no dispute that Petitioner relies on Smith as disclosing micromirrors being pivotable about two axes. Petitioner explains that Smith describes a "multi-wavelength . . . optical switch including an array of mirrors tiltable about two axes, both to control the switching and to provide variable power transmission." Pet. 31 (quoting Ex. 1004, Abstract). Patent Owner does not dispute that Smith discloses individually controllable micromirrors pivotable about two axes, or that such control is used "to reflect" and "to control the power," as recited by claim 1.

The dispute of the parties with regard to Smith more significantly focuses on whether Smith discloses "continuous control." As discussed above, we reject Petitioner's assertion that "continuous control" means "under analog control," and determine instead that the term encompasses "under analog control such that it can be continuously adjusted." According to Petitioner:

> Smith teaches continuous control of its MEMS mirrors in an analog manner, where the force used to tilt the mirrors is "approximately ***linearly*** proportional to the magnitude of the applied voltage." ([Ex. 1004], 15:41–42, emphasis added, 6–35; 17:1–23; [Ex. 1028] ¶ 64.) This linear proportionality is another way of describing a continuous, analog, relationship between the

> voltage driving the mirrors and the resulting mirror angle. ([Ex. 1028] ¶¶ 64–65.)

Pet. 29. The Smith '683 Provisional also states that elements "can be rotated in an analog fashion." Ex. 1005, 6. Stating that the control is "in an analog manner" or reflects an "analog" relationship, however, is not sufficient to persuasively establish that the mirrors of Smith are "under analog control." Nor has Petitioner sufficiently shown that the "analog fashion" referred to in the Smith '683 Provisional necessarily was carried forward to Smith.

Patent Owner further asserts with respect to Smith that a person of ordinary skill in the art "would have viewed tilting according to large angles and small angles and [pulse width modulation] more akin to step-wise digital control than analog control." PO Resp. 47 (further indicating that other patents and patent applications related to Smith use digital control). In response, Petitioner does not dispute that Smith relies on digital control, but instead argues that Dr. Sergienko testified that digital control does not preclude "continuous control." Pet. Reply 22. We agree that "continuous control" is not limited to analog control; however, Petitioner's contention is that Smith discloses "continuous control" because Smith discloses "analog control," not that digital control in Smith is "continuous control." We are not persuaded that Smith discloses "continuous control" on this record because Petitioner has not shown either that the mirrors of Smith are "under analog control" or that Smith's use of digital control constitutes "continuous control."

Petitioner also contends that Lin discloses "continuous control." Pet. 30–31. Lin describes a spatial light modulator (SLM) operable in the

analog mode for light beam steering or scanning applications. Ex. 1010, Abstract. Figures 3A and 3B of Lin are reproduced below.

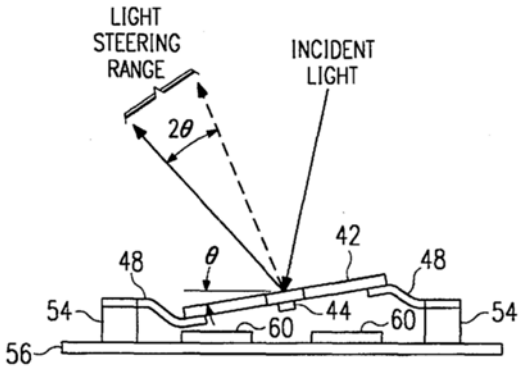

FIG. 3A

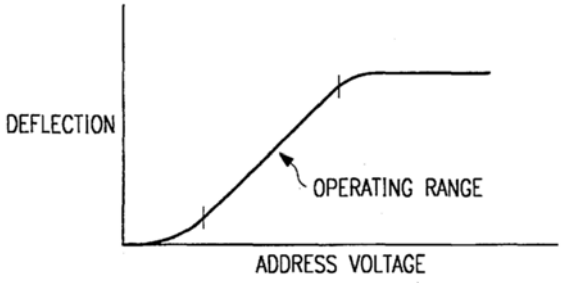

FIG. 3B

Figure 3A is a spatial light modulator, "illustrating the pixel being deflected about the torsion hinge to steer incident light in a selected direction, the deflection of the pixel being a function of the voltage applied to the underlying address electrode." Ex. 1010, 5:20–25. As Petitioner explains, Figure 3B shows a graph disclosing the continuous deflection angle of MEMS mirrors as a function of the voltage applied to affect that deflection. Pet. 30. Dr. Marom testifies that Lin "confirms that continuous and analog control of MEMS mirrors was known prior to the '678 patent's priority date." Ex. 1028 ¶ 66. Lin explains that "the angular deflection of mirror 42 about the torsional axis defined by hinges 44 is seen to be a function of the

voltage potential applied to one of the address electrodes 60." Ex. 1010, 6:29–32. Lin further explains that:

> With an address voltage being applied to one address electrode 60 being from 0 to 20 volts, mirror 42 is deflected proportional to the address voltage. When SLM 40 is operated as an optical switch or light steerer, incident light can be precisely steered to a receiver such as an optical sensor or scanner. The mirror tilt angle can be achieved with a excellent accuracy for pixel steering.

Id. at 7:13–19.

Patent Owner argues that Petitioner hasn't shown that Lin discloses continuous control because such control cannot be shown by the input signal alone, and Petitioner did not "look at the structure of the mirror and how the voltage affects movement of the mirror." PO Resp. 51. Patent Owner's conclusory and unsupported argument is not persuasive because it does not address the disclosures of Lin as summarized above, which we find establish "continuous control," as recited in claim 1.

Patent Owner also argues that Lin does not disclose micromirrors "pivotable about two axes." *Id.* at 51–52. Petitioner, however, relies on Smith, not Lin, as disclosing 2-axis mirrors, and there is no contention that Lin, alone, discloses continuous control in two dimensions.

In summary, for the reasons discussed above, Petitioner has established that Bouevitch discloses all of the recited limitations of claim l for multiple fiber collimators, a wavelength-separator, a beam-focuser, and a spatial array of channel micromirrors individually and continuously controllable on a single axis, but not on a two axis (i.e., "pivotal about two axes") array "to reflect said corresponding received spectral channels into any selected ones of said output ports and to control the power of said

received spectral channels coupled into said output ports." Patent Owner did not dispute that Bouevitch discloses continuous control of beam-deflecting elements via analog voltage control with respect to a single axis, and Petitioner has demonstrated that Lin also discloses such "continuous control." Finally, Petitioner has established that Smith discloses an array of mirrors controllable in two dimensions "to reflect" and "to control," as recited by claim 1. Thus, the remaining issue is whether Petitioner has provided "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007).[12]

With respect to a rationale for combining Bouevitch and Smith, Petitioner contends the use of the two-axis mirror of Smith in Bouevitch: (1) is a simple substitution of one known element for another yielding predictable results, (2) is the use of a known technique to improve similar devices, (3) would be obvious to try as there are only two options for tilting MEMS mirrors: one-axis and two-axis mirrors, and (4) would be motivated to reduce crosstalk in attenuation and to increase port density. Pet. 19–22.[13]

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[12] The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, and (3) the level of skill in the art; and (4) secondary considerations, i.e. objective evidence of unobviousness. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We have considered each of the Graham factors and incorporate our discussion of those considerations, to the extent there is a dispute, in our evaluation of the reasoning that supports the asserted combination. We further observe that, in this proceeding, evidence of secondary considerations has not been offered for evaluation.

[13] Petitioner also argues, without citing authority, that Patent Owner

Petitioner also contends that several reasons support the addition of Lin's continuous, analog control to the asserted combination, including interchangeability with discrete-step mirrors and more precision in matching the optimal coupling value. Pet. 30–31.

Patent Owner disputes the sufficiency of the rationale provided in the Petition. PO Resp. 15–32. First, Patent Owner argues that Petitioner "conflates disparate embodiments of Bouevitch," "one functioning in a DGE to control power [shown in Bouevitch Figure 5] and one functioning in a COADM to control switching [shown in Bouevitch Figure 11]." *Id.* at 16–17. Petitioner, however, persuasively explains that it does not rely on an embodiment of Bouevitch functioning to control power to show that the features of claim 1 were disclosed in the asserted art. Pet. Reply 2–3 ("[Bouevitch] Fig. 5 is not relevant to Petitioner's positions or the institution."). Instead, Petitioner relies on Smith as disclosing power control, stating in the Petition that "Smith describes a 'multi-wavelength . . . optical switch including an array of mirrors tiltable about two axes, both to control the switching and to provide variable power transmission.'" Pet. 31 (quoting Ex. 1004, Abstract).

Although Petitioner includes a discussion of Bouevitch's disclosure of power control in the Petition, it is clear that the asserted combination does not stand or fall on that disclosure. The Petition states that a person of ordinary skill in the art "would be motivated to use the 2-axis system of

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admitted the "combinability" of references during prosecution, and that such admission applies to the references identified by Petitioner in "the identical technology area." Pet. 22. We find no such admission.

Smith within the system of Bouevitch for power control." Pet. 34 (citing Ex. 1028 ¶ 78). Petitioner's discussion of the power control embodiment of Bouevitch in support of the rationale for the asserted combination with Smith (i.e., both Smith and Bouevitch address power control) does not impose an obligation on Petitioner to articulate a rationale for including the power control embodiment of Bouevitch in the asserted combination.

Patent Owner also argues that Petitioner implicitly relies on the power control embodiment of Bouevitch to show that Bouevitch discloses beam-deflecting mirrors that are continuously controllable. PO Resp. 21. We are persuaded that, to the extent Petitioner relies on Bouevitch as disclosing reflectors that are continuously controllable based on the power control embodiment of Bouevitch (*see* Pet. 28–29 (quoting Ex. 1001 discussing the embodiment shown in Figure 5 of Bouevitch)), Petitioner was obligated to, and did not, provide a rationale for combining an embodiment of Bouevitch directed to power control with an embodiment relied on by Petitioner to show switching control.[14] Petitioner, however, further relies on Lin as disclosing continuous control. Accordingly, Petitioner may show unpatentability based on the combination of Bouevitch, Smith, and Lin without relying on the power control embodiment of Bouevitch, and without

[14] Petitioner argues in its Reply that Bouevitch teaches a MEMS structure for switching in Figure 11 that also performs power control; however, Petitioner has not shown sufficiently that it presented this contention in the Petition, or that its arguments were not intertwined with its assertions related to Bouevitch Figure 5. Similarly, Petitioner did not contend in the Petition, as it does in its Reply, that Bouevitch inherently discloses angular misalignment for power control. *See* Pet. Reply 4. Arguments made for the first time in a reply generally are not given consideration.

providing a rationale for incorporating the power control embodiment of Bouevitch in the asserted combination.

Patent Owner also argues that a person of ordinary skill in the art would not have combined Bouevitch and Smith for various reasons. PO Resp. 23–32. Patent Owner argues that Petitioner has not reconciled "the technical differences between the references," or explained whether the components "would continue to operate as desired." *Id.* at 23. Patent Owner lists many considerations an optical system architect would have to take into account purportedly not addressed in the Petition. *Id.* at 23–25. Patent Owner further asserts that Dr. Marom has designed a two-axis mirror to replace a two-axis mirror, and that "[r]e-designing micromirrors is not a simple substitution because the redesign is complex." *Id.* at 25–26. In this proceeding, however, Dr. Sergienko was asked whether such technical considerations presented problems that could not be overcome by one of skill in the art, and indicated "no." Ex. 1049, 266:16–267:25. Moreover, "[t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference. . . . Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art." *In re Keller*, 642 F.2d 413, 425 (CCPA 1981). Here, the test for obviousness reflects what the combined teachings of Bouevitch, Lin, and Smith would have suggested to one of ordinary skill in the art, and does not require that any one particular component of a reference must be bodily incorporated, or physically inserted, into another reference.

Patent Owner argues more particularly that a person of ordinary skill in the art "would not have been motivated to use Smith's mirrors in the Bouevitch's Figure 5 embodiment." PO Resp. 26–27. Patent Owner's argument is not persuasive because, as discussed above, Petitioner does not rely on the Figure 5 embodiment in Bouevitch.

Next, Patent Owner argues that a person of ordinary skill in the art would not have been motivated to combine Smith's tiltable mirrors with Bouevitch because it "would disrupt Bouevitch's explicit teaching of parallel alignment," and "Bouevitch discourages, if not teaches away from, misalignment to control power." PO Resp. 27–30. "The prior art's mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed in the . . . application." *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). Although Bouevitch discusses how angular displacement is disadvantageous in certain respects (*see* Ex. 1003, 2:1–7), we are not persuaded such discussion is sufficient to constitute a teaching away. To the contrary, Petitioner has shown persuasively that Bouevitch uses angular misalignment to control power in at least some embodiments of Bouevitch. Pet. Reply 3–5; *see also* Ex. 1028 ¶ 76.

Patent Owner also argues that absent hindsight, a person of ordinary skill would not have incorporated the two-axis mirror of Smith into Bouevitch, which uses a one-axis mirror, because a two-axis mirror is "a more complex structure." PO Resp. 30–32. We find Patent Owner's argument conclusory and not persuasive because it fails to address the

benefits of a two-axis mirror disclosed by Smith, which would be apparent to one of skill in the art without hindsight. *See* Ex. 1004, 7:1–52. We also find persuasive Petitioner's contention that it would have been obvious to try, because, as Dr. Marom testified, (1) there were only two solutions to the known need to deflect light beams with MEMS: 1-axis or 2-axis, (2) a person of ordinary skill would have had a high expectation of success to try two-axis mirror control in Bouevitch, and (3) the result of the combination would be predictable. *See* Pet. 21; Pet. Reply 6–7; Ex. 1028 ¶ 46.

With respect to Lin, Patent Owner argues that Petitioner fails to explain either how the multiple axes of Smith could be combined with Lin's analog control or how to modify Lin's structural elements to incorporate a two-dimensional rotation, and further asserts that, because Lin's structural elements would be considered obstacles, a person of ordinary skill "would not necessarily have found it obvious to combine Smit and Lin." PO Resp. 53–54. As explained above, however, the test for obviousness is not whether the features of one reference may be bodily incorporated into the structure of another reference. Moreover, the references of record reflect that there are routinely complex design considerations in the fiber optic communications field. Patent Owner does not explain persuasively why combining the teachings of Smith and Lin would be beyond the skill of a skilled artisan.

Petitioner has articulated sufficiently reasoning with some rational underpinning to support the legal conclusion of obviousness based on the asserted combination of Bouevitch, Smith, and Lin. With regard to incorporating the teaching of a two-axis mirror in Smith with Bouevitch, we

are persuaded that it is a simple substitution, notwithstanding the fact that it may require substantial engineering as a practical matter. Single-axis and two-axis mirrors were known to be interchangeable. Smith not only expressly acknowledges this interchangeability, but also identifies benefits to the use of a two-axis mirror: "[i]n comparison to the two-axis embodiment, single axis systems may be realized using simpler, single axis MEMS arrays but suffer from increased potential for crosstalk between channels." Ex. 1004, 18:17–18; Ex. 1005, 12; *see also* Ex. 1004, 16:55–58, Ex. 1005, 11 ("[b]oth single and dual axis mirror arrays may be used in a variety of switching configurations, although, the two-axis components are preferred."). The asserted combination of Smith and Bouevitch and Lin yields a predictable result. *See KSR*, 550 U.S. at 416 ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.").

We are further persuaded that Petitioner has identified additional "rational underpinning" in support of the asserted combination. Dr. Marom testified that applying the two-axis mirror of Smith to Bouevitch would have been beneficial "because choosing only a single axis for both port selection and attenuation may result in dynamic fluctuations of power crosstalk between ports as attenuation level is varied," would reduce "the risk of the signal bleeding into a port that is adjacent to the output port along the switching axis," and would provide "finer control over the attenuation value" by allowing the use of "the full dynamic range of the mirror tilt in the first axis for attenuation." *See* Ex. 1028 ¶¶ 78–80; *see also* Pet. 21–22. For similar reasons Petitioner has also shown that the application of Smith to

Bouevitch constitutes the use of known techniques to improve similar devices. *See* Pet. 20–21.

We also find persuasive Petitioner's contention that a person of ordinary skill in the art would have combined the teachings of Lin with Bouevitch and Smith because:

> (1) continuously controlled mirrors were known to be interchangeable with discrete-step mirrors; (2) continuously controlled mirrors allow arbitrary positioning of mirrors and can more precisely match the optimal coupling value; and (3) Lin specifically teaches that its analog, continuous MEMS mirrors would be useful in optical switching applications like Bouevitch's and Smith's ROADM devices.

Pet. 30–31 (citing Ex. 1010, 2:6–9; Ex. 1028 ¶ 67). Petitioner also has shown that the use of analog continuous control was the known alternative to discrete (or step-wise) control, and would have been obvious to try and expected to work when applied to Bouevitch. Pet. 31 (citing Ex. 1028 ¶¶ 68–70).

For the foregoing reasons, Petitioner has established by a preponderance of the evidence that claim 1 would have been obvious over Bouevitch, Smith, and Lin.[15]

2. Claims 2–4

Claim 2 depends from claim 1, and further requires "a servo-control assembly, in communication with said channel micromirrors and said output ports, for providing control of said channel micromirrors and thereby maintaining a predetermined coupling of each reflected spectral channel into

[15] Patent Owner provides no persuasive evidence of secondary considerations to support the patentability of claims of the '678 patent.

one of said output ports." Claim 3 depends from claim 2, and further requires "said servo-control assembly comprises a spectral monitor for monitoring power levels of said spectral channels coupled into said output ports, and a processing unit responsive to said power levels for providing control of said channel micromirrors." Claim 4 depends from claim 3, and further requires that "said servo-control assembly maintains said power levels at a predetermined value."

The '678 patent states that:

> The electronic circuitry and the associated signal processing algorithm/software for such processing unit in a servo-control system are known in the art. A skilled artisan will know how to implement a suitable spectral monitor along with an appropriate processing unit to provide a servo-control assembly in a WSP-S apparatus according to the present invention, for a given application.

Ex. 1001, 12:9–15. Accordingly, the '678 patent expressly recognizes that the additional features of claims 2–4 were "known in the art" to a skilled artisan and would have been obvious to implement.

We agree with Petitioner's contention that Smith's disclosure of a controller that receives feedback from an optical power monitor corresponds to the servo-control assembly and spectral monitor of claims 2–4, and serves the same purpose. Pet. 35–43 (citing, *inter alia*, Ex. 1004, Fig. 8, 18:42–53, 13:20–24). Concerning "coupling," as claimed, we find persuasive Petitioner's explanation that:

> Smith discloses the use of "fine control along one or more minor axes…to moderate the degree of coupling of a wavelength channel," and shows at least two different types of coupling control in Figures 17 and 18. (Smith Pat., 7:32–44; 16:63–17:53 ("The fundamental control mechanism of the optical switches

> based on tilting mirrors is the degree of coupling between the free-space optical beams within the switch and the waveguides of the concentrator."); Marom Decl., ¶ 87; *see also* Smith Prov., 10, Fig. 4, 22:17–19.) This coupling angle must be predetermined because the coupling controls the power levels, which are themselves predetermined.

Pet. 38.

With regard to claim 4, we agree with Petitioner that Smith teaches that the controller "adjust[s] the mirror positions to adjust the transmitted power to conform to one or more *predetermined criteria*." Pet. 42–43 (quoting Ex. 1004, 11:48–51).

Petitioner also provides sufficient articulated reasoning with some rational underpinning to support the combination of the Smith controller and optical power monitor with Bouevitch, including "as an alternative to the 'external feedback' for power control that Bouevitch explains should be eliminated," and that a person of ordinary skill "would appreciate that the feedback-driven control of Smith would improve the precision of the mirror-based switching system of Bouevitch." Pet. 36–41. Petitioner also reasons that it would have been obvious to try the predetermined power settings of Smith within Bouevitch, because "Smith teaches that predetermined power values could make up for inherent problems in optical switching, such as power variations from optical amplifiers and manufacturing and environmental variations, and because 'WDM systems must maintain a significant degree of uniformity of power levels across the WDM spectrum.'" *Id.* at 43 (quoting Ex. 1004, 6:24–50; citing Ex. 1028 ¶ 92).

Patent Owner argues that Petitioner fails to explain how or why a person of ordinary skill would have been able to add Smith's control

features to Bouevitch without disrupting Bouevitch's operation. PO Resp. 55–57. As noted above, the obviousness test has no bodily incorporation requirement, and is instead focused on "what the combined teachings of those references would have suggested to those of ordinary skill in the art." *See Keller*, 642 F.2d at 425. Patent Owner does not address the disclosure of the '678 patent, which states that a "skilled artisan will know how to implement a suitable spectral monitor," or the reasoning provided by Petitioner.[16] We have considered Patent Owner's arguments and find them to be insufficiently supported and conclusory. On the other hand, we conclude that Petitioner's reasoning (Pet. 35–43) is sound and supported adequately by the record. Petitioner has established by a preponderance of the evidence that claims 2–4 would have been obvious over Bouevitch, Smith, and Lin.

3. Claims 9, 10, 13, 19, and 20

Claims 9, 10, 13, 19, and 20 ultimately depend from claim 1. In addition to addressing the elements of claim 1, we agree with Petitioner's identification of how claims 9, 10, 13, 19, and 20 would have been obvious over Bouevitch, Smith, and Lin. Claim 9 requires that "each channel micromirror is continuously pivotable about one axis," while claim 10 requires "each channel micromirror is pivotable about two axes." Bouevitch

[16] For example, Patent Owner argues that "Petitioner says that Smith's internal feedback is an alternative to Bouevitch's external feedback." PO Resp. 57. Patent Owner misrepresents Petitioner's argument. Petitioner actually states that "[i]t would be obvious to [a person of ordinary skill] to try the internal feedback loop in Smith for use in Bouevitch as an alternative to the 'external feedback' for power control that Bouevitch explains should be eliminated." Pet. 36.

discloses micromirrors continuously pivotable about one axis (Ex. 1003, 14:5–65, 15:30–34), Smith discloses mirrors that are continuously-pivotable in two axes (which includes "pivotable about one axis") (Ex. 1004, Abstract, 7:1–44, Fig. 14), and Bouevitch, Smith and Lin all disclose mirrors that are "continuously" pivotable. (Ex. 1003, 7:35–37, 12:59–60; Ex. 1004, 15:41–42; Ex. 1010, Fig. 3B, 2:66–3:14).

Claim 13 requires that the fiber collimators "are arranged in a one-dimensional array." Both Bouevitch and Smith disclose the claimed feature. *See* Pet. 44–45 (citing Ex. 1003, 13:9–18, Figs. 2a, 2b, 9b–9d, 5:22–42; Ex. 1004, Figs. 5, 6, 4:16–24).

Claim 19 requires that "each output port carries a single one of said spectral channels," a feature disclosed by Bouevitch. Pet. 47 (citing Ex. 1003, 14:27–15:18).

Claim 20 requires "one or more optical sensors, optically coupled to said output ports," a feature disclosed by Smith. Pet. 48 (Citing Ex. 1004, 9:11–15, 9:7–52). We also find persuasive Petitioner's rationale for applying the optical sensors taught by Smith to Bouevitch to "provide a more accurate measurement of the device's output power" and to provide "increased accuracy for power control." Pet. 48.

Patent Owner has not raised additional arguments with respect to claims 9, 10, 13, 19, and 20 beyond those asserted with respect to claim 1, addressed above. We have assessed the information provided and determine that Petitioner has established by a preponderance of the evidence that claims 9, 10, 13, 19, and 20 would have been obvious over Bouevitch, Smith, and Lin for the same reasons discussed above with respect to claim 1.

4. Claims 21–23 and 27

Independent claim 21 recites many features substantially the same as features of claim 1, with the addition of "a servo-control assembly," as recited by claim 2. However, unlike claim 1, claim 21 does not require that the channel micromirrors be "pivotal about two axes" or that they "control the power." Petitioner provides an element-by-element analysis of each feature of claim 21, relying in substantial part on its discussion of the same features from claims 1 and 2. Pet. 49–51. Claim 22 depends from claim 21 and requires the same additional features recited in claim 3. Claim 23 depends from claim 22 and requires the same additional features recited in claim 4. Claim 27 depends from claim 21 and requires the same additional features recited in claim 9. Petitioner contends claims 22, 23, and 27 would have been obvious for the same reasons provided with respect to claims 3, 4, and 9.

Patent Owner has not raised additional arguments with respect to claims 21–23 and 27 beyond those asserted with respect to claims 1–4 and 9, addressed above. We have assessed the information provided and determine that Petitioner has established by a preponderance of the evidence that claims 21–23 and 27 would have been obvious over Bouevitch, Smith, and Lin for the same reasons discussed above with respect to claims 1–4 and 9.

5. Claims 44–46

Independent claim 44 generally recites features substantially the same as features of claim 1, with relatively minor differences. For example, claim 1 recites a "wavelength-separating-routing apparatus" and "multiple fiber collimators," whereas claim 44 recites an "optical system comprising a

wavelength-separating-routing apparatus" and "an array of fiber collimators." Unlike claim 1, claim 44 further requires "a pass-through port and one or more drop ports" among the plurality of output ports, and recites "said pass-through port receives a subset of said spectral channels."

We agree with Petitioner's contentions with respect to claim 44:

> Bouevitch also discloses that the output port can be used as the pass-through port of element 44[a] when the "modifying means" of the Bouevitch's ROADM allows a light beam to pass through unchanged. ([Ex. 1003], 6:20–25; [Ex. 1028] ¶ 131). Bouevitch teaches another output port in the form of "OUT DROP" drop port in element 80b, port 3. [] Bouevitch also discloses additional output ports. (*Id.*, 10:56–61 ("wherein each band has its own corresponding in/out/add/drop ports.") Each of these ports is provided by and comprised of microlens microcollimators. ([Ex. 1028] ¶ 131.)

Pet. 53–54. Claim 45 depends from claim 44 and requires the same additional features recited in claim 2. Claim 46 depends from claim 45 and requires the same additional features recited in claim 3.

Patent Owner has not raised additional arguments with respect to claims 44–46 beyond those asserted with respect to claims 1–3, addressed above. We have assessed the information provided and determine that Petitioner has established by a preponderance of the evidence that claims 44–46 would have been obvious over Bouevitch, Smith, and Lin as discussed above, and for the same reasons provided with respect to claims 1–3.

6. Claims 61–65

Claim 61 is a method claim that parallels the features of claim 1. For example, claim 1 recites "a wavelength-separator, for separating said multi-wavelength optical signal from said input port into multiple spectral

channels," whereas claim 61 recites "separating said multi-wavelength optical signal into multiple spectral channels." Petitioner contends, and Patent Owner does not dispute, that the only substantive difference between claim 1 and claim 61 is the replacement of the term "individually and continuously controllable" in claim 1 with "dynamically and continuously controlling" in claim 61. Pet. 55. Although we do not adopt Petitioner's proposed construction of "dynamically," Petitioner has demonstrated that both Bouevitch and Smith disclose "dynamically" controlling. We agree with Petitioner's contentions with respect to claim 61:

> Both Bouevitch and Smith teach "dynamic" control during the operation of their add/drop devices. ([Ex. 1028], ¶ 145.) Bouevitch discloses a "dynamic gain equalizer and/or configurable add/drop multiplexer," which includes dynamic control of the mirrors that perform those actions. ([Ex. 1003], 2:24–25; [Ex. 1028] ¶ 145.) Smith notes that it "is well known" that power control "should be dynamic and under feedback control since the various wavelength components vary in intensity with time." [Ex. 1004], 6:37–50 (emphasis added); 2:23–31, 7:24–31.) The Smith Provisional also supports dynamic control, as is apparent from the fact that the Smith ROADM processes control signals/commands as it operates. (*See* [Ex. 1005], Figs. 11, 7; [Ex. 1028] ¶ 145.)

Pet. 58.

Claim 62 depends from claim 61 and, similar to claim 2, further requires "the step of providing feedback control of said beam-deflecting elements to maintain a predetermining coupling of each spectral channel directed into one of said signal output ports." We agree with Petitioner that "Smith discloses this feedback control in the form of a "controller" that receives feedback from an 'optical power monitor.' ([Ex. 1004], 18:42–53,

8:2–4, 13:20–24, Fig. 12, 8:3–4, 9:29–10:13, 13:20–14:15; [Ex. 1005], Figs. 4, 11.)."

Claim 63 depends from claim 62 and substantively requires the same additional features recited in claim 4. Claim 64 depends from claim 62 and substantively requires the same additional features recited in claim 19. Claim 65 depends from claim 61 and requires the same additional features recited in claim 44.

Patent Owner has not raised additional arguments with respect to claims 61–65 beyond those asserted with respect to claims 1, 2, 4, 19, and 44 addressed above. We have assessed the information provided and determine that Petitioner has established by a preponderance of the evidence that claims 61–65 would have been obvious over Bouevitch, Smith, and Lin as discussed above, and for the same reasons provided with respect to claims 1, 2, 4, 19, and 44.

E. Asserted Obviousness Over Bouevitch, Smith, Lin, and Dueck

Petitioner contends claims 17, 29, and 53 would have been obvious over Bouevitch, Smith, Lin, and Dueck. Pet. 45–47, 55. Claim 17, which depends from claim 1, and claim 53, which depends from claim 44, both further require "said wavelength-separator comprises an element selected from the group consisting of ruled diffraction gratings, h[o]lographic diffraction gratings, echelle gratings, curved diffraction gratings, and dispersing gratings."[17] Claim 29 contains essentially the same recitation, but refers to "dispersing prisms" in place of "dispersing gratings."

[17] Claim 17 appears to misspell "holographic" as "halographic."

Petitioner contends that any of the types of wavelength-selective devices recited in claim 12 would have been obvious because "[e]ach type was known in the prior art, each was interchangeable as a wavelength-selective device, and each was one of a small set of possible choices." Pet. 46 (citing Ex. 1028 ¶ 112).[18] Petitioner also contends that Dueck discloses ruled diffraction gratings, as claimed. Pet. 48. Petitioner further asserts that it would have been obvious to try Dueck's ruled diffraction gratings in the devices of Bouevitch and Smith because it represents the "best mode" of separating wavelengths in WDM devices. *Id.* at 46–47. We agree with Petitioner's contentions.

Patent Owner argues that a person of ordinary skill would not have been motivated to use Dueck's diffraction grating. PO Resp. 55–55. According to Patent Owner, Dueck discloses a diffraction grating that reflects an input light beam to an output port at very nearly the same angle as the incident angle. *Id.* Patent Owner reasons that because no configuration shown in Bouevitch is designed to reflect a light beam at the same angle as Dueck, there is no motivation to use Dueck's diffraction grating in Bouevitch. *Id.* In reply, Petitioner asserts that Dueck was relied on only to show "prior-art knowledge of diffraction gratings in general." Pet. Reply 23. As noted above, the obviousness test has no bodily incorporation requirement, and is instead focused on "what the combined teachings of those references would have suggested to those of ordinary skill in the art."

[18] Patent Owner suggests that because trial was instituted on a ground that included Dueck, we are precluded from considering Petitioner's arguments that claims 17, 29, and 53 would have been obvious without Dueck. *See* PO Resp. 54. Our Institution Decision in this case contained no such limitation.

See Keller, 642 F.2d at 425. While the particular configuration of the ruled diffraction grating in Dueck may not be readily incorporated into Bouevitch, Dueck nonetheless discloses the broader concept of a ruled diffraction grating. Indeed, Dr. Sergienko testified that a ruled diffraction grating could have been used in Bouevitch, as well as holographic diffraction grating, or an echelle grating, as they are all reasonable substitutes for one another and would be expected to work. *See* Ex. 1049, 256:13–259:7.

We have assessed the information provided and determine that Petitioner has established by a preponderance of the evidence that claims 17, 29, and 53 would have been obvious over Bouevitch, Smith, Lin, and Dueck.

F. Conclusion

Petitioner has shown by a preponderance of the evidence that claims 1–4, 9, 10, 13, 19–23, 27, 44–46, and 61–65 would have been obvious over Bouevitch, Smith, and Lin, and that claims 17, 29, and 53 would have been obvious over Bouevitch, Smith, Lin, and Dueck.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, based on a preponderance of the evidence, claims 1–4, 9, 10, 13, 17, 19–23, 27, 29, 44–46, 53, and 61–65 of U.S. Patent No. RE42,678 E1 are unpatentable; and,

FURTHER ORDERED that, because this is a Final Written Decision, the parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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